Published in final edited form as:

Psychol Aging. 2010 September ; 25(3): 505–515. doi:10.1037/a0019456.

The structure and health correlates of trait repetitive thought in older adults

Suzanne C. Segerstrom, Abbey R. Roach, Daniel R. Evans, and Lindsey J. Schipper

Department of Psychology, University of Kentucky

Audrey K. Darville

College of Nursing, University of Kentucky

Abstract

Repetitive thought (RT) involves frequent or prolonged thoughts about oneself and one's world, encompassing discrete forms such as trait worry, rumination, processing, and reminiscing. These forms of RT can be described using three basic, underlying qualities: total propensity for RT of all types, valence (positive versus negative content), and purpose (searching or uncertainty versus solving or certainty). The adaptiveness of discrete forms with regard to health is likely to be related to these qualities, particularly valence and total propensity. The present study confirmed the model and identified the relationship of these qualities of RT to subjective psychological, physical, and cognitive health in older adults aged 60–94 ($N = 179$). As predicted, more negatively valenced trait RT was associated with worse psychological, physical, and cognitive health. More total propensity for RT was associated only with worse psychological health. Searching purpose was associated only with worse cognitive health. In turn, negatively valenced RT was predicted by poorer executive functions, suggesting that such functions may be important for directing this quality of RT. The valence of older adults' RT is important insofar as it may contribute to their sense of good or ill health. However, the propensity for all kinds of RT to associate with poorer psychological health may reflect the co-occurrence of negative and positive RT, such as rumination and emotional processing. Although RT has not been extensively investigated in older adults, it appears to play an important role in their subjective health.

Keywords

worry; rumination; processing; health; executive functions

Repetitive thought (RT), defined as “the process of thinking attentively, repetitively, or frequently about oneself and one's world” is an important determinant of psychological and physical well-being (Segerstrom, Stanton, Alden, & Shortridge, 2003, p. 909). Forms of RT such as worry and rumination both contemporaneously and prospectively increase negative mood states such as anxiety and depression and dysregulate physiological systems such as the cardiovascular and immune systems (e.g., Kubzansky, Kawachi, Spiro, Weiss, Vokonas, & Sparrow, 1997; Nolen-Hoeksema, 1991; Nolen-Hoeksema & Morrow, 1991; Pieper,

Correspondence should be addressed to Suzanne C. Segerstrom, Department of Psychology, University of Kentucky, 115 Kastle Hall, Lexington, KY 40506-0044. Segerstrom@uky.edu .

Publisher's Disclaimer: The following manuscript is the final accepted manuscript. It has not been subjected to the final copyediting, fact-checking, and proofreading required for formal publication. It is not the definitive, publisher-authenticated version. The American Psychological Association and its Council of Editors disclaim any responsibility or liabilities for errors or omissions of this manuscript version, any version derived from this manuscript by NIH, or other third parties. The published version is available at www.apa.org/pubs/journals/pag

Brosschot, van der Leeden, & Thayer, 2007; Segerstrom & Kemeny, 2006; Segerstrom, Solomon, Kemeny, & Fahey, 1998; Segerstrom, Tsao, Alden, & Craske, 2000; Spasojević & Alloy, 2001; Watkins, 2008). Equally repetitive but qualitatively different RT such as emotional or cognitive processing can promote psychological and physical well-being (Bower, Kemeny, Taylor, & Fahey, 1998; Salsman, Segerstrom, Brechting, Carlson, & Andrykowski, 2009). In older adults, rumination and worry predispose to depression and immune dysregulation, particularly in combination with stressful events, whereas reminiscing may promote satisfaction and positive affect (e.g., Bodnar & Kiecolt-Glaser, 1994; Parker, 1999; Segerstrom, Schipper, & Greenberg, 2008; Webster & McCall, 1999).

This body of research on the relationship between RT and health has largely focused on distinct forms of RT. However, each form of RT, such as worry or reminiscing, is composed of more basic, underlying qualities. In evaluating the relationships among forms of RT, three such qualities emerge (Evans & Segerstrom, 2010; Segerstrom et al., 2003). *Valence* contrasts positive content (e.g., personal success, interpersonal harmony) with negative content (e.g., failure, conflict). *Purpose* contrasts searching (e.g., uncertainty, exploring possibilities) with solving (e.g., certainty, planning). Finally, *total* RT, comprising the propensity to engage in RT regardless of type, reflects the degree to which a person has a general tendency to think attentively, repetitively, or frequently (Segerstrom et al., 2003). There are stable individual differences in these RT qualities, particularly valence (Roach, Salt, & Segerstrom, in press).

Because discrete RT forms are made up of a combination of all of these qualities, findings using discrete forms can be obscure. For example, trait worry is lower in older than in young adults (Basevitz, Pushkar, Chaikelson, Conway, & Dalton, 2008). Trait worry is a joint function of high total RT (i.e., the tendency to think repetitively), negative valence (i.e., the tendency to think about possible negative events), and solving purpose (i.e., the propensity to seek certainty and solve problems; Basevitz et al., 2008; Davey, 1994). The same total worry score can be obtained from different combinations of these propensities. Therefore, which of these qualities of worry – amount, valence, purpose, or some combination thereof – varies between age groups is impossible to tell. Heterogeneous constructs such as worry can compromise the ability to effectively link the more homogeneous underlying mechanisms to their consequences (Smith, McCarthy, & Zapolski, in press). The primary aim of the present study, therefore, was to uncover underlying qualities of RT forms and relate these qualities to psychological, physical, and cognitive health in older adults. The secondary aims were to provide validity evidence for RT measures in older adults and preliminary evidence for neuropsychological underpinnings of RT qualities.

RT qualities have predicted subjective health across psychological, cognitive, and health domains in young and middle-aged adults. In general, positive RT valence correlated strongly with subjective health across psychological, cognitive, and physical health domains. Purpose was also relevant insofar as it moderated the effect of valence (Segerstrom et al., 2003). Prospective effects of RT on health suggest that RT may have a causal influence. Maladaptive qualities of RT likely compromise health by generating and prolonging negative views and schemas of oneself and one's world, essentially acting as internally generated, chronic stressors (Brosschot, Gerin, & Thayer, 2006). Adaptive qualities of RT may promote health by prolonging positive views and acting as internally generated positive events (Bryant, 2003). It is important to note that, conversely, health – and particularly psychological health – may make certain qualities of RT more likely. For example, negative mood states make negatively valenced thoughts more accessible (Blaney, 1986). However, as noted above, the differential correlates of the underlying qualities of RT with regard to health have rarely been tested in young adults and not at all in older adults.

In addition to linking the underlying qualities of RT to health, it is important to understand factors that may contribute to these qualities. Aging is associated with increased variability in executive functions, such as inhibiting prepotent responses and shifting mental set, as some older adults experience losses while others maintain good functioning (Hedden & Gabrieli, 2004; Hull et al., 2008). Older adults with poorer executive functions may have RT content that is more negatively valenced than that of their peers with maintained functions. In older adults, poor “cognitive control” correlates with more negatively valenced attentional and memory bias (Mather & Knight, 2005). Poorer performance on tests of executive functions also correlated with susceptibility to maladaptive forms of RT such as depressive rumination for both older and young adults (Crowe, Matthews, & Walkenhorst, 2007; Davis & Nolen Hoeksema, 2000; von Hippel, Vasey, Gonda, & Stern, 2008; Whitmer & Banich, 2007). One important question is whether the correlation between poorer executive functions and maladaptive RT is due to loss of control over valence or loss of ability to inhibit RT in general. As noted previously, examination of a single RT construct such as worry or rumination prohibits a clear answer to this question.

The present study

For the present study, we took a wide-ranging view of the properties of subjectively experienced health that could be affected by RT (Rowe & Kahn, 1987). Psychological health includes the absence of negative states such as depression, which are promoted by maladaptive RT (Watkins, 2008). However, positive states such as personal growth also contribute to health, and RT promotes these states as well (Bower et al., 1998; Ryff, 1989; Salsman et al., 2009). Finally, cognitive and physical domains are also important to subjectively experienced health. For older adults, the sense that one is in good physical health not only contributes to a global sense of health but also predicts lower mortality above and beyond known risk factors (Idler & Benyamini, 1997).

The aims of the present study were to test the following hypotheses in older adults:

1. Valence, purpose, and total amount will characterize the RT of older adults, as they have in younger adults (Evans & Segerstrom, 2010; Segerstrom et al., 2003). Furthermore, these qualities will have construct validity vis a vis the content of episodic RT.
2. Trait RT qualities correlate with subjective psychological, cognitive, and physical health. Specifically, more negative and total RT – qualities that are associated with maladaptive forms of RT – will be associated with poorer health, and these effects may be moderated by purpose.
3. Better executive functions will be associated with less total RT as well as more positively valenced RT.

Method

Participants

Participants were 179 older adults with a mean age of 75 (range = 60-93). The gender ratio (60% female) approximated the gender ratio of older adults in the general population. The majority, 96%, of the sample was white and 4%, African-American. The sample reported a median of 16 years of education, although there was also significant variability (range = 7 – 22).

Participants were drawn from two studies of RT and health (see Figure 1). The first was a longitudinal study of RT and health in spousal dementia caregivers (N = 21) and

demographically matched, married controls ($N = 42$) (hereafter, the “caregiver study”). Two controls were matched to each caregiver. The second was a study of RT, stress, and health in community-dwelling, married older adults ($N = 150$) (hereafter, the “community study”). At the end of the caregiver study, 34 participants (11 caregivers and 23 controls) enrolled in the community study. Considering the overlap between samples, the total N was 179.

Because these studies also involved measurement of immunity (see Segerstrom et al., 2008), both studies excluded individuals who had diseases or disorders affecting the immune system or chemotherapy or radiation treatment within the past 5 years, were unwilling to undergo vaccination or venipuncture, were taking immunomodulatory medications including opiates and steroids, and were taking more than 2 of the following classes of medications: psychotropics, antihypertensives, hormone replacement, or thyroid supplements. Therefore, participants were generally healthy, although they reported typical disorders of aging including diabetes (14%), heart disease (34%), and hypertension (62%).

Participants in both studies were recruited from a pool maintained by the Sanders-Brown Center on Aging at the University of Kentucky. As expected, therefore, a multivariate analysis on demographic variables (age, sex, and education) revealed no differences between the two studies, between caregivers and non-caregivers across the two studies, or the interaction between study and caregiver status (all $p > .15$). The proportion of caregivers enrolling in the caregiver study (21/64, 33%) and the proportion carrying over to the community study (11/34, 32%) are the same as the proportion of adults providing care in a national survey (34%; Kutner, 2001) and those reporting caregiving duties in the remainder of the community study (i.e., those not carrying over from the caregiver study; 40/116; 34%). Therefore, caregivers were not oversampled in relation to national or local norms.

Procedure

Participants were interviewed in their homes. Scales were verbally administered with the assistance of response cards. Participants in the caregiver study also completed a written, free-response description of what was “on their mind” as a measure of episodic RT at each visit. They received either \$10 at each interview (caregiver study) or \$20 (community study) for their participation.

In the caregiver study, participants were recruited over a period of 5 years. They were interviewed and completed descriptions of their current RT every six months until the end of the study or they dropped out. Participants completed a mean of 4 RT descriptions (range = 1 to 9). Variability in the number of completed waves resulted from drop-outs, deaths, and varying time from recruitment to the end of the study.

All studies were conducted with the approval of the University of Kentucky Institutional Review Board.

Measures

Demographics and health—Participants reported on demographics at the first interview. They also provided a list of all prescription medications, which were category-coded by a graduate-level nurse. These medication categories were then used to derive a Chronic Disease Score, which quantifies chronic disease burden; the raw score reflects predicted health care costs over the next year and predicts hospitalization and death (Clark, von Korff, Saunders, Baluch, & Simon, 1995).

Trait repetitive thought—Participants completed trait RT measures on entry into either study (see Figure 1). Participants continuing from the caregiver to the community study ($N =$

34) were administered two scales that were not part of the caregiver study (Savoring Beliefs Scale, Impact of Event Scale) on entry into the community study. For those not continuing (N = 29), these scores, which represent 5% of trait RT data, were imputed using the EM (maximum likelihood estimation) algorithm in SPSS. This type of imputation prevents listwise deletion while avoiding bias in the estimates (Schafer & Graham, 2002). With these exceptions, all scores were taken from the initial administration of the scales in either the caregiver (N = 63) or community (N = 116) studies.

Worry was measured with the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990), a measure of uncontrollable, pervasive worry (e.g., “My worries overwhelm me”).

Intrusions were measured with the intrusions subscale of the Impact of Event Scale (Horowitz, Wilner, & Alvarez, 1979), which was administered with regard to the most important event occurring during the previous 6 months as identified on an event checklist.

Rumination was measured using the Rumination Scale (Martin, Tesser, & McIntosh, 1993). It has two subscales (Segerstrom et al., 2003): lack of control (e.g., “I often get distracted from what I am doing by thoughts about something else”) and cognitive rehearsal (e.g., “When I know that I am going to have an important talk or an argument with someone in the near future, I rehearse in my mind what I will say and what they will probably say in response”). Internal consistency for the rehearsal subscale was .44 in this sample; due to its low consistency, the rehearsal subscale was not used.

Depressive rumination was measured with the rumination subscale of the Response Styles Questionnaire (Nolen-Hoeksema, 1991), which captures RT responses when the respondent is “sad, down or depressed”. It has three subscales (Segerstrom et al., 2003; cf., Treynor, Gonzalez, & Nolen-Hoeksema, 2003): depressive symptom focus (e.g., “think about how alone I feel”), depressive self-analysis (e.g., “go away by myself to think about why I feel this way”), and depressive self-reproach (e.g., “think, ‘Why do I have problems other people don’t have?’”).

Rumination and reflection were measured with the respective subscales of the Rumination-Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999), which assesses RT about threats to the self (e.g., “I tend to ‘ruminate’ or dwell over things that happen to me for a really long time afterward”) and reflections on the self motivated by intellectual curiosity (e.g., “I love exploring my ‘inner’ self”).

Emotional processing was measured with the processing scale of the Emotional Approach Coping questionnaire (Stanton et al., 2000). The items (e.g., “I take time to figure out what I’m really feeling”) were administered with the instruction to respond regarding “what you usually do when you are under a lot of stress ... by ‘stressful’ we mean situations that are difficult or troubling to you.”

Savoring was measured with the Savoring Beliefs Scale (Bryant, 2003). The scale measures reminiscing (e.g., “I like to store memories of fun times that I go through so that I can recall them later”), savoring (e.g., “When something good happens, I can make my enjoyment of it last longer by thinking or doing certain things”), and anticipating (e.g., “I can make myself feel good by imagining what a happy time that is about to happen will be like”).

Episodic repetitive thought—In the caregiver study, participants were asked to provide a written description of their episodic RT. The instructions were nondirective regarding the content of thought, asking only that participants describe “something that has been on your mind lately; that is, you have thought about it frequently and/or for extended periods of

time” (Segerstrom et al., 2003). Caregivers completed an additional description regarding their thoughts about their spouses’ illness.

RT descriptions were rated using the Repetitive Thought 2-Dimension coding system (RT2D; Roach et al., in press; Segerstrom et al., 2003). Three raters coded each description for thought valence and thought purpose. Valence scores ranged from 1 = mostly positive (as indicated by, e.g., statements such as, “Life is in good balance” and “A new Sunday School class for newlyweds in my church – I will be team teaching and am quite involved and excited about it”) to 5 = mostly negative (e.g., “Our relationship is somewhat strained because of the change in both our attitudes” and “I have more thoughts of dying...with my medical history, when will it occur, will I know”). Purpose scores ranged from 1 = mostly solving (e.g., “Being gardeners, vegetable and flower, this is the time of year that many things have to be done in preparation for winter. This is on our minds everyday” and “I have worried about my daughter’s work status. I have checked job opportunities”) to 5 = mostly searching (e.g., “I wondered if I made the right decision” and “The question is whether there is evidence of further deterioration ... my thought process invariably ends with, ‘I do not know’”). Some descriptions could not be rated on both dimensions because they were too brief (i.e., if the majority of coders judged there to be too little information to make a valid rating on a dimension, no rating was entered; 11 from controls, 3 from caregivers). Inter-rater reliability was .92 for valence and .87 for purpose for the unconstrained-topic description of RT; for the description of RT about the spouse’s illness, reliability was .86 for valence and .90 for purpose.

Well-being—Well-being measures were administered on entry into the community study (see Figure 1). Three measures of psychological health (perceived stress, depression, and psychological well-being) were highly correlated (r ’s = .58 - .75). Reversing stress and depression scores, the sum of Z scores of these measures formed an internally consistent composite (α = .86), which was used in analysis.

Perceived stress was measured with the Perceived Stress Scale (Cohen & Williamson, 1988), which measures the degree to which stress is appraised as negative, unpredictable, uncontrollable, and overloading. Internal consistency was adequate (.88).

Depression was measured with the Geriatric Depression Scale (Yesavage et al., 1983). The GDS is a measure of depression that is appropriate for administration to older adults, who may have inflated scores on other depression measures due to somatic complaints associated with aging. Three items from the GDS measure RT: “Are you bothered by thoughts you can’t get out of your head?”, “Do you frequently worry about the future?”, and “Do you worry a lot about the past?” To avoid criterion contamination, depression scores were calculated without these items. Internal consistency was adequate (.85).

Psychological well-being was measured using Ryff’s (1989) Scales of Psychological Well-Being. The scales include autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance, which were individually internally consistent (.78-.88) and formed an internally consistent composite (.89).

Subjective health was measured using a single item from the Medical Outcomes Study (MOS) Health-Related Quality of Life scale (Stewart & Ware, 1992) asking participants to characterize their health as excellent, very good, good, fair or poor.

Subjective cognitive function was measured with the Cognitive Functioning subscale of the Medical Outcomes Study (MOS) Health-Related Quality of Life scale (Stewart & Ware, 1992). Items ask about difficulty in reasoning, concentrating, focus, memory, attention, and reaction time.

Neuropsychological tests—In the community study, participants completed neuropsychological tests including the North American Adult Reading Test (NAART) and the Trail Making Test (TMT). The NAART provides an estimate of IQ. The TMT Part A (numbers) captures motor speed and visual search; performance on Part B (letters and numbers) relative to Part A captures executive functions including cognitive flexibility, attentional control, and working memory (Arbuthnott & Frank, 2000; Korte, Horner, & Windham, 2002). For the purpose of predicting RT, we were interested in executive functions, which should contribute to the ability to direct one's RT toward desirable topics over undesirable ones as well as the ability to limit RT. Therefore, we used a standard derived index for the TMT, the difference between the time to complete the two parts (Drane, Yuspeh, Huthwaite, & Klinger, 2002). This index captures the degree to which the additional executive demands of Part B do not pose an extra challenge to the individual above and beyond the motor speed and visual search inherent in both Part A and Part B. Because this score was calculated as TMT A – TMT B, higher scores reflect better executive functions.

Data Analysis

We employed three main data analytic strategies: Multidimensional scaling, multi-level modeling, and hierarchical regression. Alpha was set at .05, two-tailed, for all inferential tests.

Hypothesis 1 stated that valence, purpose, and total amount will characterize the RT of older adults. The corresponding analyses proceeded in two steps, using both caregiver and community study participants ($N = 179$). First, all RT measures were converted to Z scores and the relationships among them examined for a general propensity to RT using item-total correlations and the mean correlation among the measures. These analyses were expected to generate evidence for individual differences in total RT.

Second, qualitative differences in RT were uncovered using multidimensional scaling. The multidimensional model was constructed using ALSCAL in SPSS. Distances between RT measures were calculated as 1 minus the correlation between the two measures and treated as interval data. All correlations were corrected for attenuation before analysis to prevent distances between measures with lower internal consistency from being overestimated. There were 12 total measures, allowing us to test one-, two-, and three-dimensional models according to the recommendations provided by Kruskal and Wish (1978). Model fit was assessed by stress values, a measure that is comparable to the square root of the residual sum of squares when the model is used to estimate the initial distance matrix. This analysis was expected to generate evidence for valence and purpose qualities in RT. Note that this approach yields similar results to those that would arise from an unrotated principal components analysis (Davison, 1985): a component reflecting the common variance shared among members (with weights analogous to item-total correlations) and additional components that discriminate among the members (with weights analogous to scaling results). However, multidimensional scaling is a more intuitive way of representing this structure and has been identified as more appropriate for analyzing and representing circumplex structure, to which RT measures have conformed in the past (Davison, 1994; Segerstrom et al., 2003).

Qualities emerging from trait RT questionnaires were expected to be valid with regard to the content of RT. Qualities of trait RT were compared with qualities of episodic RT using caregiver study participants ($N = 63$). We used multi-level modeling (MLM; Singer & Willett, 2003), which accommodates unbalanced longitudinal designs. Person-level RT (from trait RT questionnaires) predicted visit-level, episodic RT (from coded descriptions of state RT). Each quality (i.e., valence and purpose) was modeled separately. The models were tested using SAS PROC MIXED with maximum likelihood estimation (Singer, 2002). Results are reported as γ weights with their standard errors and associated F tests from the Type III sums of squares. γ is analogous to the unstandardized beta weight; because these parameters vary as a function

of scaling, the standard effect size η is also reported. η can be interpreted on the same scale as r : .10 effects are considered small; .30, medium; and .50, large (Cohen, 1987).

Hypotheses 2 and 3 proposed that the qualities of trait RT would predict health and be predicted by neuropsychological function. The relationships among RT qualities, health measures, and neuropsychological performance were tested using community study participants ($N = 150$) using both zero-order correlations and regression models. Regression models controlled for age and gender, followed by main effects of valence and purpose and total RT in the second step, all two-way interactions in the third, and the three-way interaction in the fourth. RT qualities were largely orthogonal (see Table 2) with mean = 0 and therefore collinearity did not pose a problem to the interpretation of the main effects or the interactions. Regression was also used to test the effects of executive functions on RT qualities, before and after controlling for IQ. We expected that RT would reflect absolute executive functions rather than relative executive functions with regard to IQ; however, the latter possibility was also tested.

Results

The structure of repetitive thought in older adults

Bivariate correlations between RT measures ranged from $-.48$ (rumination with savoring) to $.79$ (anticipation with reminiscing). Transforming all correlations to z scores, taking the mean, and converting back to r yielded a mean correlation of $.17$ with a 95% confidence interval of $.08 - .25$. Therefore, there was some evidence for a general propensity for RT. Table 1 shows the means and item-total correlations for the RT measures. As further evidence for a general propensity, all measures, with the exception of savoring, had positive item-total correlations.

RT measures were subjected to multidimensional scaling. Kruskal's stress 1 values for one-, two-, and three-dimensional models were $.158$, $.091$, and $.056$, respectively. Although the second and third dimensions each reduced stress, examination of the third dimension indicated that it reflected measurement artifact in that it acted to reduce distance between related subscales (e.g., the subscales of the Savoring Beliefs Scale). Therefore, the 2-dimensional model was selected. The 2-dimensional model accounted for 82% of the variance.

Figure 2 shows the solution. Dimension 1 had positively valenced RT such as emotional processing, anticipating, and reminiscing at one extreme and negatively valenced RT such as intrusions, depressive self-reproach, and depressive symptom focus at the other extreme. Dimension 2 had solving RT such as reminiscing and savoring at one end of the spectrum and searching RT such as reflection and depressive self-analysis at the other end. Hypothesis 1 was therefore confirmed by the evidence for three qualities of RT in older adults: total RT as a general propensity and valence and purpose as qualitative dimensions.

Further analyses employed valence and purpose scores calculated for each participant by standardizing each scale score and weighting the participant's standardized score by the dimension coefficient for that scale. Therefore, high scores on scales located at the negative end of the valence dimension and low scores on scales located at the positive end of the valence dimension would yield a highly negatively valenced dimension score. Higher dimension scores on valence reflected more positive valence, whereas higher dimension scores on purpose reflected more solving purpose. A sum of all standardized scores reflected total RT.

Trait repetitive thought qualities: Correlation with state assessments

To examine the validity of the valence and purpose qualities with regard to episodic thought content, trait questionnaire scores for the participants in the caregiver study predicted coded valence and purpose in episodic RT descriptions over the course of the study. Effects of time (visit number) and topic (unconstrained topic versus spousal illness) were accounted for. For

valence, visit did not affect episodic thought ($F < 1.0$), but topic did, such that thoughts about spousal illness were more negatively valenced than those about free-choice topics ($\gamma = -.63$ ($SE = .14$), $F(1,226) = 19.57$, $p < .0001$, $\eta = .28$). For purpose, later visits were associated with increases in solving ($F(9,214) = 2.44$, $p < .05$, $\eta = .31$), but topic did not affect purpose ($F(1,222) = 3.06$, $p > .05$). Therefore, all valence analyses controlled for topic and all purpose analyses controlled for visit.

There was a significant effect of trait valence (i.e., from questionnaires) on episodic valence (i.e., from RT descriptions) ($\gamma = -.05$ ($SE = .02$), $F(1,226) = 9.24$, $p < .01$, $\eta = .20$), such that more positive trait scores were associated with more positive episodic RT. (Note that higher coded scores reflect more negative episodic RT, whereas higher trait scores reflect more positive trait RT.) However, there was not a significant effect of trait purpose on episodic purpose ($\gamma = .016$ ($SE = .03$), $F(1,214) = 0.07$, $p > .05$, $\eta = .02$). Therefore, positively valenced responses on trait RT questionnaires prospectively predicted more positively valenced RT over up to 5 years, but more searching responses on trait RT questionnaires did not predict more searching RT during the follow-up period. Therefore, this part of Hypothesis 1 was supported with regard to valence but not with regard to purpose.

Health: Associations with repetitive thought qualities

Table 2 shows the zero-order correlations among RT qualities, health, and neuropsychological variables in the community study, and Table 3 shows the results of the regression models.¹ Both correlations and regression main effects indicated that more positively valenced RT was associated with better psychological, cognitive, and physical health. Solving purpose was associated only with better cognitive health. Therefore, individuals who endorsed searching items such as “I love analyzing why I do things” (reflection) and “[I] analyze my personality to try to understand why I am depressed” (depressive self-analysis) also endorsed, for example, worse attention and memory. Finally, total RT was associated only with worse psychological health. Therefore, Hypothesis 2, which posited that negative and total RT would be associated with poorer health, was supported.

These effects were largely unmoderated, and therefore did not unanimously support the prediction from Hypothesis 2 that purpose would moderate the effects of valence. However, there were two significant interactions. For physical health, the two-way interaction between valence and total RT was significant. The sign of this interaction indicated that the total propensity for RT amplified the relationship between valence and physical health; that is, the valence effect became stronger at higher levels of total RT. For cognitive health, the three-way interaction between valence, purpose, and total RT was significant, partially supporting the moderating relationship predicted in Hypothesis 2. Figure 3 shows predicted cognitive health as a function of high (+1 SD) and low (−1 SD) levels of valence, purpose, and total RT. The associations between better cognitive health and positive valence and solving purpose (i.e., the

¹It should be noted that the dimension scores included the Symptom Focus subscale of depressive rumination. This scale is recognized to overlap with symptoms of depression; logically, if one does not have a particular symptom, one is not spending significant time ruminating about it (e.g., Segerstrom, Tsao, Craske, & Alden, 1997). Therefore, we recalculated the dimension scores without the Symptom Focus subscale and correlated dimension scores with and without the subscale. These correlations were $> .99$ for both valence and purpose. Therefore, inclusion of the Symptom Focus subscale did not substantially influence the dimension scores such that it could have inflated relationships with the measures of health.

The effect of caregiver status on RT and the relationship between RT and health was also explored. Spousal caregivers did not differ from non-caregivers in RT total ($t(176) = -0.47$, $p > .05$), valence ($t(176) = 1.46$, $p > .05$), or purpose ($t(176) = 0.57$, $p > .05$), indicating that RT qualities are not merely a proxy for life circumstances (c.f., Segerstrom et al., 2008). In hierarchical regressions entering the interactions between caregiver status and each RT quality in a final step after controlling for gender, age, and main effects, the interactions step did not account for significantly more variance in psychological health ($\Delta R^2 = .02$, $F(3, 140) = 1.89$, $p > .05$), subjective cognitive health ($\Delta R^2 = .02$, $F(3, 140) = 0.55$, $p > .05$) or subjective physical health ($\Delta R^2 = .01$, $F(3, 140) = 0.92$, $p > .05$). Only one term approached statistical significance, in which the negative relationship between total RT and psychological health was stronger among caregivers ($\beta = -.12$, $p < .06$).

main effects) are evident in the figure. However, the qualities combined differently depending on whether the RT was negatively or positively valenced. When RT was negatively valenced, the relationship between searching and poorer subjective cognitive health was largest with high levels of total RT. When RT was positively valenced, however, the relationship between searching and poorer subjective cognitive health was largest with *low* total RT.

Subjective cognitive and physical health had objective correlates: performance on neuropsychological tests and Chronic Disease Score, respectively (see Table 2). However, adding these correlates to the first step of the regression models did not substantively affect the results. Therefore, RT predicted the evaluation of one's own cognitive health above and beyond IQ and executive functions and physical health above and beyond the presence and extent of chronic disease.

Executive functions and repetitive thought

Table 4 shows the results of regressing executive functions as measured by the Trail Making Test on RT qualities and total RT. Demographic controls were entered in the first step and TMT score was entered in the second step. Executive functions and IQ were significantly but modestly correlated (see Table 2), so the estimate of full-scale IQ from the NAART was entered in the third step in order to assess its influence on the executive functions estimate as well as its own predictive utility. As predicted in Hypothesis 3, poorer executive functions were associated with more negative RT and, to a lesser extent, more searching, but not with total RT. In contrast, higher IQ was associated with more solving and more total RT. Therefore, it appears that IQ was associated with endorsement of more RT regardless of valence, but only executive functions were associated with directing those thoughts toward more positive content.

Discussion

Repetitive thought (RT) has been related to a number of important outcomes, including psychological health, physiological regulation, and physical health (Bower et al., 1998; Kubzansky et al., 1997; Nolen-Hoeksema, 1991; Pieper et al., 2007; Salsman et al., 2009; Segerstrom & Kemeny, 2006; Segerstrom et al., 1998, 2000, 2003). The present study identified the underlying qualities of RT in older adults and established the construct and predictive validity of these qualities. A model of RT in older adults that focuses on the underlying properties of RT should provide a stepping stone to understanding both the processes underlying RT in this population and the consequences. Most investigations of RT in older adults have focused on a single, discrete form such as worry (e.g., Basevitz et al., 2008), but the present results suggest that a more comprehensive assessment is not only possible but desirable in characterizing older adults' RT. As previously identified in younger samples (Evans et al., 2010; Segerstrom et al., 2003), RT in older adults has three important qualities: valence, purpose, and total RT. As previously noted, the advantage to this understanding of RT is the ability to disentangle these three qualities, which have different correlates in episodic RT, health, and neuropsychological abilities.

Valence

There were stable and construct-valid individual differences in valence, such that people who endorsed more positive RT on trait questionnaires also described more positive episodic RT prospectively over a period up to 5 years. Individual differences in RT valence correlated more highly than either of the other two qualities with health, with more positive RT associated with better subjective psychological, physical, and cognitive health. The correspondence between trait RT valence and the content of RT descriptions suggests that these correlations are not merely due to shared questionnaire method variance. Furthermore, the stability of valence over

time as demonstrated in the caregiver study suggests that positive RT might also correlate with better health longitudinally. However, these cross-sectional results cannot speak to the temporal precedence of RT or health, and it is also possible that life events or circumstances affected both RT and health. If that were true, the question arises: How are the effects of external events translated into internal experience such as subjective health? RT about events might be a means by which such translation occurs.

There was not a significant correlation between age and positivity within older adults. The correlation suggested that the older members of the sample tended to think slightly more negatively, $r = -.10$, but this effect of age accounted for no more than 1% of the variance in valence. If older adults have a tendency to focus more on positive events and emotions (i.e., as predicted by socioemotional selectivity theory; Carstensen, Isaacowitz, & Charles, 1999), and RT valence has significant effects on health, there should be a positive relationship between RT valence and age both within people (increasing positivity bias with age) and between people (survival bias favoring positive thinkers). One possibility is that motivations or pressures toward positive RT with older age are offset by other pressures toward more negative RT. In a different domain, higher social satisfaction as predicted by socioemotional selectivity can be completely offset by lower executive functions, reduced activity levels, and more social isolation (von Hippel, Henry, & Matovic, 2008). Although older adults tend to think more positively than young adults (Roach et al., in press), changes within older adulthood in executive functions, life events (e.g., social losses), or both may affect the relationship between RT valence and age. The present research begins to explore this possibility with the finding that those older adults with poorer executive functions (including cognitive flexibility, attentional control, and working memory) had more negatively valenced RT.

Purpose

The meaning and importance of RT purpose in trait questionnaires was less clear. Trait RT purpose did not predict the degree to which people described searching or solving in their episodic RT. This finding may be due to the limited stability of purpose in episodic thought; there is simply little stable purpose variance in episodic thought to be predicted (Roach et al., in press). However, correlations with both objective and subjective cognitive health suggest that there is substantive meaning to this quality in trait questionnaires. Participants with more objective (e.g., IQ) and subjective cognitive resources were less likely to endorse searching RT such as depressive self-analysis, reflection, and processing. Although these scales imply an intellectual kind of self-analysis (Trapnell & Campbell, 1999) that has been proposed to require cognitive resources in older adults (Staudinger, 2001), these results indicate that *lower* levels of cognitive functioning correlated with searching. It is possible that searching impairs cognitive function because it draws on cognitive resources to a greater degree than solving. Notably, this relationship is not a function of control over one's thoughts, as executive functions were more closely related to valence than to purpose. Another possibility, given that purpose in trait questionnaires was not related to purpose in episodic reports, is that higher objective and subjective cognitive function leads to a meta-cognitive impression of more solving and less searching.

Although purpose has moderated the effects of valence in previous research (e.g., Segerstrom et al., 2003), there were no significant interactions between valence and purpose. The only moderated relationship also involved total RT in predicting perceived cognitive health. In this three-way interaction, the highest levels of cognitive health were associated with low amounts of positive solving and the lowest, with high amounts of negative searching. Again, these are cross-sectional results that may indicate the way RT affects the way people experience their own cognitive functioning, the thinking that results from good cognitive health, or both.

Total RT

Most theoretical and empirical comparisons of RT have focused on the qualitative characteristics rather than the quantitative. However, some people are merely more prone than others to think repetitively about themselves and their worlds. This is reflected in the positive mean correlation among RT measures in both young and, in the current study, older adults (Segerstrom et al., 2003). This propensity deserves further consideration. Above and beyond qualitative valence and purpose, total amount of RT was associated with worse psychological health, and it amplified the correlation between valence and physical health. Apparently more RT of both positive and negative valence accompanies indicators of poor psychological health such as perceived stress, depression, lack of autonomy, and so on. The presence of poor psychological health may provoke increased RT about one's negative mood states (e.g., depressive symptom focus) as well as increased positive RT as a compensatory activity to reduce them (e.g., emotional processing). Therefore, RT may be playing a role in regulating emotions in older adults (c.f., Isaacowitz, Toner, Goren, & Wilson, 2008). Because total RT was also predicted by IQ, one possibility for future investigation is that high-IQ older adults are more likely to use RT as a means of emotion regulation.

Limitations and conclusions

The present study has several important strengths, including a relatively large sample size and multi-method assessment (questionnaires, unstructured written descriptions, and neuropsychological testing). However, there are some limitations that should be acknowledged. First, although the participants were representative of the local population of older adults in terms of age, sex, and race, they had a higher estimated IQ than the population average, albeit in the context of a reasonably large range ($M = 113$, $SD = 9$, range = 84 – 127), and this IQ was estimated from a short reading test rather than a conventional intelligence test. Likewise, executive functions were measured using only the Trail Making Test. Although this limited assessment is characteristic of many studies of cognitive function and RT (though see von Hippel et al., 2008, for an exception), future studies could elucidate whether specific aspects of intelligence (e.g., verbal intelligence) or executive functions (e.g., inhibition) are particularly important for RT.

Second, although we attempted to sample a broad representation of RT questionnaires from all quadrants of the structure, we necessarily did not include all constructs that might qualify as RT. For example, mind-wandering is a state that occurs when the contents of cognition inadvertently turn away from present activities. It is more likely to occur when people are fatigued, stressed, or bored. In addition to these situational predictors, there are likely to be stable individual differences, as mind-wandering is more likely among those with poor executive functions (Kane et al., 2007). To our knowledge, however, there is not a trait measure of mind-wandering *per se* that we could have included in the present study. As more measures of trait RT are developed (e.g., the Responses to Positive Affect Questionnaire; Feldman, Joormann & Johnson, 2008), more representatives of each quadrant can and should be included in comprehensive RT assessments.

Conversely, some of the constructs we included were better examples of RT than others. In particular, we included the Savoring Beliefs Scale in an effort to represent both positive and negative RT, including types that have been associated with well-being in older adults (i.e., reminiscing). Although thoughts about the past (reminiscing) and future (anticipating) did correlate with a propensity for RT (see Table 1), enjoyment of the present (savoring) did not. This is sensible when one considers that the present does not require as much cognitive representation and elaboration as do the future and the past. Finally, as noted above, most of these measures were obtained cross-sectionally. Although intriguing causal paths are suggested, they await multi-wave, longitudinal work.

The goal of the present study was to examine the structure, validity, and correlates of RT in older adults. Breaking RT down to its fundamental qualities revealed different correlates and potential consequences of these qualities. Individual differences in RT valence were the best correlate of health, with more positively valenced thoughts correlating with better health. These individual differences might arise from executive functions, which have been linked with ability to self-regulate in general and regulate thought content specifically. Total RT was elevated with poor psychological health, which may also suggest RT as an emotion regulation mechanism insofar as distress may provoke RT. The results, therefore, seem to point to RT as a self-regulatory mechanism which, when applied well, may have health-protective effects in older adults. This remains an important direction for future investigation. Although RT has not been extensively investigated in older adults, it appears to play an important role in how they manage and maintain their well-being and deserves further attention in this age group.

Acknowledgments

This research was supported by the Dana Foundation and the National Institute on Aging (R01-AG026307 and P50-AG05144).

References

- Arbuthnott K, Frank J. Trail Making Test, Part B as a measure of executive control: Validation using a set-switching paradigm. *Journal of Clinical and Experimental Neuropsychology* 2000;22:518–528. [PubMed: 10923061]
- Basevitz P, Pushkar D, Chaikelson J, Conway M, Dalton C. Age-related differences in worry and related processes. *International Journal of Aging and Human Development* 2008;66:283–305. [PubMed: 18507331]
- Blaney PH. Affect and memory: A review. *Psychological Bulletin* 1986;99:229–246. [PubMed: 3515383]
- Bodnar JC, Kiecolt-Glaser JK. Caregiver depression after bereavement: Chronic stress isn't over when it's over. *Psychology and Aging* 1994;9:372–380. [PubMed: 7999322]
- Bower JE, Kemeny ME, Taylor SE, Fahey JL. Cognitive processing, discovery of meaning, CD4 decline, and AIDS-related mortality among bereaved HIV-seropositive men. *Journal of Consulting and Clinical Psychology* 1998;66:979–986. [PubMed: 9874911]
- Brosschot JF, Gerin W, Thayer JF. The perseverative cognition hypothesis: A review of worry, prolonged stress-related physiological activation, and health. *Journal of Psychosomatic Research* 2006;60:113–124. [PubMed: 16439263]
- Bryant FB. Savoring Beliefs Inventory (SBI): A scale for measuring beliefs about savouring. *Journal of Mental Health* 2003;12:175–196.
- Carstensen LL, Isaacowitz DM, Charles ST. Taking time seriously: A theory of socioemotional selectivity. *American Psychologist* 1999;54:165–181. [PubMed: 10199217]
- Clark DO, von Korff M, Saunders K, Baluch WM, Simon GE. A chronic disease score with empirically derived weights. *Medical Care* 1995;33:783–795. [PubMed: 7637401]
- Cohen, J. *Statistical power analysis for the behavioral sciences*: Revised edition. Lawrence Erlbaum Associates; Hillsdale, NJ: 1987.
- Cohen, S.; Williamson, GM. Perceived stress in a probability sample of the United States. In: Spacapan, S.; Oskamp, S., editors. *The social psychology of health*. Sage; Newbury Park: 1988. p. 31–67.
- Crowe SF, Matthews C, Walkenhorst E. Relationship between worry, anxiety and thought suppression, and the components of working memory in a non-clinical sample. *Australian Psychologist* 2007;42:170–177.
- Davey, GCL. Pathological worrying as exacerbated problem-solving. In: Davey, GCL.; Tallis, F., editors. *Worrying: Perspectives on Theory, Assessment, and Treatment*. Wiley; New York: 1994. p. 35–59.
- Davis RN, Nolen-Hoeksema S. Cognitive inflexibility among ruminators and nonruminators. *Cognitive Therapy and Research* 2000;24:699–711.
- Davison ML. Multidimensional scaling versus components analysis of test intercorrelations. *Psychological Bulletin* 1985;97:94–105.

- Davison, ML. Multidimensional scaling models of personality responding. In: Strack, S.; Lorr, M., editors. *Differentiating Normal and Abnormal Personality*. Springer; New York: 1994. p. 196-215.
- Drane DL, Yuspeh RL, Huthwaite JS, Klinger LK. Demographic characteristics and normative observations for derived Trail Making Test indices. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology* 2002;15:39-43.
- Evans, DR.; Segerstrom, SC. Mindfulness, repetitive thought, and self-regulation. 2009. Manuscript under review
- Feldman GC, Joormann J, Johnson SL. Responses to positive affect: A self-report measure of rumination and dampening. *Cognitive Therapy and Research* 2008;32:507-525. [PubMed: 20360998]
- Hedden T, Gabrieli JDE. Insights into the ageing mind: A view from cognitive neuroscience. *Nature Reviews Neuroscience* 2004;5:87-97.
- Horowitz MJ, Wilner N, Alvarez W. Impact of Event Scale: A measure of subjective stress. *Psychosomatic Medicine* 1979;41:209-218. [PubMed: 472086]
- Hull R, Martin RC, Beier ME, Lane D, Hamilton AC. Executive function in older adults: A structural equation modeling approach. *Neuropsychology* 2008;22:508-522. [PubMed: 18590362]
- Idler EL, Benyamini Y. Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health and Social Behavior* 1997;38:21-37. [PubMed: 9097506]
- Isaacowitz DM, Toner K, Goren D, Wilson HR. Looking while unhappy: Mood-congruent gaze in young adults, positive gaze in older adults. *Psychological Science* 2008;19:848-853. [PubMed: 18947348]
- Kane MJ, Brown LH, McVay JC, Silvia PJ, Myin-Germeys I, Kwapil TR. For whom the mind wanders, and when: An experience-sampling study of working memory and executive control in daily life. *Psychological Science* 2007;18:614-621. [PubMed: 17614870]
- Kortte KB, Horner MD, Windham WK. The Trail Making Test, Part B: Cognitive flexibility or ability to maintain set? *Applied Neuropsychology* 2002;9:106-109. [PubMed: 12214820]
- Kruskal, JB.; Wish, M. *Multidimensional Scaling*. Sage; Beverly Hills: 1978.
- Kubzansky LD, Kawachi I, Spiro A, Weiss ST, Vokonas PS, Sparrow D. Is worrying bad for your heart? A prospective study of worry and coronary heart disease in the Normative Aging Study. *Circulation* 1997;4:818-824. [PubMed: 9054737]
- Kutner, G. AARP caregiver identification study. [Retrieved July 30, 2009]. 2001 from http://www.aarp.org/research/surveys/care/ltc/hc/articles/aarp_caregiver_identification_study.html
- Martin, LL.; Tesser, A.; McIntosh, D. Wanting but not having: The effects of unattained goals on thoughts and feelings. In: Wegner, DM.; Pennebaker, JW., editors. *Handbook of Mental Control*. Prentice Hall; Englewood Cliffs, NJ: 1993.
- Mather M, Knight M. Goal-directed memory: The role of cognitive control in older adults' emotional memory. *Psychology and Aging* 2005;20:554-570. [PubMed: 16420131]
- Meyer TJ, Miller ML, Metzger RL, Borkovec TD. Development and validation of the Penn State Worry Questionnaire. *Behaviour Research and Therapy* 1990;28:487-495. [PubMed: 2076086]
- Nolen-Hoeksema S. Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology* 1991;100:569-582. [PubMed: 1757671]
- Nolen-Hoeksema S, Morrow J. A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta earthquake. *Journal of Personality and Social Psychology* 1991;61:115-121. [PubMed: 1890582]
- Parker RG. Reminiscence as continuity: Comparison of young and older adults. *Journal of Clinical Geropsychology* 1999;5:147-157.
- Pieper S, Brosschot JF, van der Leeden R, Thayer JF. Cardiac effects of momentary assessed worry episodes and stressful events. *Psychosomatic Medicine* 2007;69:901-909. [PubMed: 17991822]
- Roach AR, Salt CE, Segerstrom SC. Generalizability of repetitive thought: Examining stability of thought content and process. *Cognitive Therapy and Research*. (in press).
- Rowe JW, Kahn RL. Human aging: Usual and successful. *Science* 1987;237:143-149. [PubMed: 3299702]
- Ryff CD. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology* 1989;57:1069-1081.

- Salsman JS, Segerstrom SC, Brechting EH, Carlson CR, Andrykowski MA. Posttraumatic growth and PTSD symptomatology among colorectal cancer survivors: A three-month longitudinal examination of cognitive processing. *Psycho-Oncology* 2009;18:30–41. [PubMed: 18481837]
- Schafer JL, Graham JW. Missing data: Our view of the state of the art. *Psychological Methods* 2002;7:147–177. [PubMed: 12090408]
- Segerstrom, SC.; Kemeny, ME. Worried to death? Stress, worry, and immune dysregulation in health and HIV. In: Plotnikoff, N.; Faith, RE.; Murgo, AJ., editors. *Cytokines, Stress, and Immunity*. 2nd Ed. CRC Press; Boca Raton, FL: 2006. p. 17-28.
- Segerstrom SC, Schipper LJ, Greenberg RN. Caregiving, repetitive thought, and immune response to vaccination in older adults. *Brain, Behavior, and Immunity* 2008;22:744–752.
- Segerstrom SC, Solomon GF, Kemeny ME, Fahey JL. Relationship of worry to immune sequelae of the Northridge earthquake. *Journal of Behavioral Medicine* 1998;21:433–450. [PubMed: 9836130]
- Segerstrom SC, Stanton AL, Alden LE, Shortridge BE. A multidimensional structure for repetitive thought: What's on your mind, and how, and how much? *Journal of Personality and Social Psychology* 2003;85:909–921. [PubMed: 14599253]
- Segerstrom SC, Tsao JCI, Alden LE, Craske MG. Worry and rumination: Repetitive thought as a concomitant and predictor of negative mood. *Cognitive Therapy and Research* 2000;24:671–688.
- Singer, JD. Fitting individual growth models using SAS PROC MIXED. In: Moskowitz, DS.; Hershberger, SL., editors. *Modeling intraindividual variability with repeated measures data: Methods and applications*. Lawrence Erlbaum Associates; Mahwah, NJ: 2002. p. 135-170.
- Singer, JD.; Willett, JB. *Applied longitudinal data analysis: Modeling change and event occurrence*. Oxford University Press; New York: 2003.
- Smith GT, McCarthy DM, Zapsolski TCB. On the value of homogeneous constructs for construct validation, theory testing, and the description of psychopathology. *Psychological Assessment*. (in press).
- Spasojević J, Alloy LB. Rumination as a common mechanism relating depressive risk factors to depression. *Emotion* 2001;1:25–37. [PubMed: 12894809]
- Stanton AL, Kirk SB, Cameron CL, Danoff-Burg S. Coping through emotional approach: Scale construction and validation. *Journal of Personality and Social Psychology* 2000;78:1150–1169. [PubMed: 10870915]
- Staudinger UM. Life reflection: A social-cognitive analysis of life review. *Review of General Psychology* 2001;5:148–160.
- Stewart, AL.; Ware, JE. *Measuring functioning and well-being: The Medical Outcomes Study approach*. Duke University Press; Durham, NC: 1992.
- Trapnell PD, Campbell JD. Private self-consciousness and the five-factor model of personality: Distinguishing rumination from reflection. *Journal of Personality and Social Psychology* 1999;76:284–304. [PubMed: 10074710]
- Treynor W, Gonzalez R, Nolen-Hoeksema S. Rumination reconsidered: A psychometric analysis. *Cognitive Therapy and Research* 2003;27:247–259.
- von Hippel W, Henry JD, Matovic D. Aging and social satisfaction: Offsetting positive and negative effects. *Psychology and Aging* 2008;23:435–439. [PubMed: 18573016]
- von Hippel W, Vasey MW, Gonda T, Stern T. Executive function deficits, rumination, and late-onset depressive symptoms in older adults. *Cognitive Therapy and Research* 2008;32:474–487.
- Watkins ER. Constructive and unconstructive repetitive thought. *Psychological Bulletin* 2008;134:163–206. [PubMed: 18298268]
- Webster JD, McCall ME. Reminiscence functions across adulthood: A replication and extension. *Journal of Adult Development* 1999;6:73–85.
- Whitmer AJ, Banich MT. Inhibition versus switching deficits in different forms of rumination. *Psychological Science* 2007;18:546–553. [PubMed: 17576269]
- Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, Leirer VO. Development and validation of a geriatric depression screening scale: A preliminary report. *Journal of Psychiatric Research* 1983;17:37–49. [PubMed: 7183759]

Figure 1.
Schematic of participation and administration of measures in the studies contributing to the present report.

Figure 2. Multidimensional scaling of trait repetitive thought for older adults. Self-analysis, symptom focus, and self-reproach refer to factors of the Response Style Questionnaire-Rumination Scale. Lack of control refers to a factor of the Rumination Scale. Savoring, reminiscing, and anticipating refer to factors of the Savoring Beliefs Scale.

Figure 3.
Predicted cognitive health as a function of valence, purpose, and total repetitive thought.

Table 1

Mean item scores and item-total correlations for repetitive thought measures

	Alpha	Mean (SD)	Range	Item-total correlation
1. Worry (PSWQ)	.92	2.4 (0.7)	1 - 5	.40
2. Intrusions (IES)	.80	1.8 (1.1)	0 - 5	.37
3. Rumination (RS)*	.72	3.4 (1.0)	1 - 7	.31
4. Depressive symptom focus (RSQ)	.84	1.8 (0.5)	1 - 4	.40
5. Depressive self-analysis (RSQ)	.81	1.5 (0.4)	1 - 4	.26
6. Depressive self-reproach (RSQ)	.77	1.7 (0.5)	1 - 4	.45
7. Rumination (RRQ)	.90	2.5 (0.7)	1 - 5	.43
8. Reflection (RRQ)	.85	2.9 (0.7)	1 - 5	.27
9. Emotional processing (EAC)	.74	2.8 (0.6)	1 - 4	.17
10. Reminiscing (SBS)	.81	5.9 (0.8)	1 - 7	.18
11. Savoring (SBS)	.81	5.8 (0.8)	1 - 7	-.04
12. Anticipation (SBS)	.81	5.9 (0.8)	1 - 7	.23

* Lack of control items only.

Note: N = 179. PSWQ = Penn State Worry Questionnaire; IES = Impact of Event Scale; RS = Rumination Scale; RSQ = Response Styles Questionnaire; RRQ = Rumination-Reflection Questionnaire; EAC = Emotional Approach Coping; SBS = Savoring Beliefs Scale

Correlations among repetitive thought qualities, demographics, neuropsychological performance, and measures of well-being

Table 2

	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Positive valence	0.06 (6.6)	-												
2. Searching purpose	-0.04 (4.0)	.06	-											
3. Total RT	0.15 (5.5)	-.15	-.03	-										
4. Gender (1 = female)	58%	.01	.23*	.31*	-									
5. Age	74.7 (6.2)	-.10	.00	-.10	-.21*	-								
6. Years of education	15.9 (2.6)	.09	-.01	.10	-.14	.11	-							
7. Chronic Disease Score	1127 (527)	-.04	.00	-.09	-.25*	.26*	-.02	-						
8. Estimated full-scale IQ (NAART)	113 (8.7)	.06	.26*	.26*	.12	.14	.32*	-.06	-					
9. Executive functions (TMT)	-66.0 (42.7)	.22*	.16*	-.03	.04	-.14	.08	-.07	.23*	-				
10. Psychological health (PSS, GDS, SPWB)	0.0 (0.9)	.74*	-.01	-.37*	-.18*	-.08	.06	-.07	-.07	.17*	-			
11. Cognitive health (MOS QOL)	30.9 (3.7)	.38*	.25*	-.12	-.15	-.13	.04	-.02	.14	.18*	.50*	-		
12. Physical (ill) health (MOS QOL)	2.3 (0.9)	-.28*	.03	.08	.04	.17	.03	.36*	.03	-.11	-.44*	-.13*	-	

*
 $p \leq .05$.

Note. N = 150. Valence and purpose scores are weighted sums of standardized trait RT scale scores. Total RT is the sum of standardized trait RT scale scores. NAART = North American Adult Reading Test; TMT = Trail Making Test; PSS = Perceived Stress Scale; GDS = Geriatric Depression Scale; SPWB = Scales of Psychological Well-Being; MOS QOL = Medical Outcomes Study Quality of Life.

Table 3

Results of regressing psychological, physical, and cognitive health on repetitive thought qualities

	Psychological health	Cognitive health	Physical (ill) health
Main effects ΔR^2	.58*	.21*	.07*
Valence β	.70*	.35*	-.26*
Purpose β	-.03	.29*	.03
Total β	-.23*	.01	.04
Two-way interactions ΔR^2	.01	.00	.04
Valence $\times$ purpose β	.06	-.03	-.11
Valence $\times$ total β	.09	-.01	-.22*
Purpose $\times$ total β	.08	-.01	.02
Three-way interaction ΔR^2	.00	.04*	.01
Valence $\times$ purpose $\times$ total β	.04	-.23*	-.09

*
 $p < .05$

Note: N = 150. All analyses controlled for age and gender. Higher valence scores indicated more positive content, and higher purpose scores, more solving.

Table 4
Results of regressing repetitive thought qualities and total repetitive thought on executive functions

Outcome	Step 2		Step 3	
	Executive functions β	ΔR^2	Executive functions β	ΔR^2
Valence	.20*	.04	.20*	-.01
Purpose	.16†	.02	.11	.24*
Total RT	-.07	.00	-.13	.23*

* $p < .05$

† $p = .05$

Note: N = 150. Step 1 controlled for age, gender, and years of education. Higher valence scores indicated more positive content, and higher purpose scores, more solving. Executive functions were from the Trail Making Test; IQ, from the North American Adult Reading Test.